Chetco Bar Area Salvage

Fire and Fuels Report

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Introduction

This report analyzes fire and fuels issues as they relate to proposed salvage activities for the Chetco Bar Area Salvage Project. Fuels treatments identified here are designed to manage material generated as a result of harvesting dead and dying trees in the project footprint. These treatments are used to manage activity generated fuels to ensure safe and effective future fire response. Forest fuels accumulation from the management actions proposed and related consequences are analyzed in the alternatives discussions.

Land and Resource Management Plan

The Rogue River-Siskiyou National Forest Land and Resource Management Plan (Rogue River-Siskiyou Forest Plan) provides standards and guidelines for fire and fuels treatments. The Siskiyou National forest Land and Resource Management Plan (USDA 1989) includes fire management direction consistent with other resource goals. Highlights from fire management are to:

Goals:

12-1 All wildfires shall receive an appropriate suppression response. The response shall be safe, timely, and cost efficient, and meet management objectives for the area including objectives for biological diversity.

12-2 The fire hazard presented by natural, activity or prior activity fuels should be reduced to appropriate levels, considering the site specific risk, and utilizing economically efficient treatment methods. The selected treatment methods should meet fuel management objectives which integrate consideration for all resource values.

12-4 Proposed activity units (harvest, thinning, conversion, release, etc.) should be designed and coordinated on the ground so that size, shape, location, timing, spatial distribution, and management risk are considered for fire management and other resource requirements and help make the fuel treatment and fire protection of the units as practical and economical as possible.

Fire intensity can be reduced by implementing such measures as:

1. Reducing the total fuel load, especially fuels in the 0-3 inch diameter class, which will reduce the damaging effects of the flaming front on soil and vegetation.

2. Reducing the amounts of large-diameter fuels on the site, which will reduce the total burning time and reduce the total amount of heat pulsed into the soil.

3. Scheduling prescribed burning to periods when fuel moistures are higher to lessen the amount of heat generated by the fire.

Fire Duration can be reduced by utilizing such techniques as:

1. Removing large material from the fuels complex to be burned, prior to ignition.

2. Scheduling prescribed burning to periods when fuel moistures are higher, to reduce the glowing or smoldering stage of the fire.

The Rogue River-Siskiyou National Forest Fire Management Plan (FMP), (USDA 2009) is an annually updated operational guide that defines how the Fire Management Program will be implemented on the Rogue River-Siskiyou National Forest. The Fire Management Program is based on achieving the resource objectives defined in the Land and Resource Management Plan (LRMP) for the Forest. The FMP is updated annually or as policy and Land and Resource Management Plans change.

The fuels management portion states that the appropriate type and amount of fuel treatment is related to the Forest Plan Management Area specific Standards and Guidelines. Levels and methods of fuel treatment are to be guided by the protection and resource objectives of each management area. Emphasis will favor ecological restoration treatments. Where appropriate, fuels treatments would allow for the utilization of wood residues.

Federal Law

The following federal laws apply to fire, fuels, and air quality management:

- Endangered Species Act
- Critical Habitat Unit
- Clean Water Act
- Clean Air Act
- Healthy Forest Restoration Act
- National Historic Preservation Act
- National Forest Management Act

Federal Policy

The following federal policies apply to fire, fuels, and air quality management:

- National Fire Plan
- National Cohesive Wildland Fire Management Strategy
- Interagency Prescribed Fire Implementation Guide

Executive Orders

The following executive orders apply to fire, fuels, and air quality management:

- Invasive Species, EO 13112 of February 3, 1999
- Migratory Birds, EO 12962 of January 10, 2001
- Environmental Justice, EO 12898 of February 11, 1994

State and Local Law

State of Oregon Smoke Management Plan (SSMP)

Resource Elements, Indicators and Measures

Fire Regime Condition Class

Coarse scale definitions for natural (historical) fire regimes have been developed and interpreted for fire and fuels management. The five natural (historical) fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity (amount of replacement) of the fire on the dominant over story vegetation (Hann et al.2003). These five regimes are as follows:

- I – 0-35 year frequency and low (surface fires most common) to mixed severity (less than 75% of the dominant over story vegetation replaced);
- II – 0-35 year frequency and high (stand replacement) severity (greater than 75% of the dominant over story vegetation replaced);
- III – 35-100+ year frequency and mixed severity (less than 75% of the dominant over story vegetation replaced);
- IV – 35-100+ year frequency and high (stand replacement) severity (greater than 75% of the dominant over story vegetation replaced);
- V – 200+ year frequency and high (stand replacement) severity.

Condition classes describe the amount of departure from the natural fire regime (Hann and Bunnell 2001) and help to describe current conditions of vegetation (structural stages, species composition, mosaic pattern) compared to historical conditions. Condition classes, numbered from 1 to 3, are generally equivalent to low, moderate, and high departure from the HRV. Condition classes also represent increasing levels of risk from uncharacteristic wildland fire behavior and effects (Hann 2004).

- FRCC I- 0-33% departure from historic condition
- FRCC II- 34-66% departure from historic condition
- FRCC III- 67+% departure from historic condition

While high severity fire effects are within the natural range of variability for the Chetco Bar fire, the spatially large and contiguous area of high severity fire is greater than what would be expected under a more typical fire regime. Except for riparian and other low lying areas, most of the Chetco Bar salvage is categorized as Fire regime 1. Areas of Fire regime 1 that have less than 75 percent of overstory vegetation loss are considered within HRV and characterized as condition class 1. Areas of Fire regime 1 that had more than 75 percent of overstory vegetation loss are departed from HRV and are best characterized as condition class 3.

Issues relevant to Chetco Bar Area salvage

1. Generation of activity fuels and their use for groundcover post-harvest will lead to fuel loadings that in the near term will contribute to higher rates of spread and greater flame lengths (Scott 2005).
2. Reducing snag densities will improve access, firefighter safety and will allow a full suite of fire management response in the event of future fire.
3. NFMA requirements to reforest harvested areas can lead to increased continuity of live fuels, which can cause increased rates of spread and fireline intensity.

Table 1. Resource elements, indicators and measures for assessing effects.

Resource element	Resource indicator	Measure (quantify if possible)	Source (LRMP S/G; law or policy, BMPs, etc.)
Activity generated fuels	Fuel loading	Fuel bed depth averaging 12" or less across treatment areas.	Fire behavior fuel modeling (Behave plus) to ensure flame lengths within initial attack capabilities.
Snags	Density	Acres	

Activity Fuels and Fire Behavior

Affected Environment

Methodology

This analysis is generated from pre-fire reference conditions compared with the post-fire Rapid Assessment of Vegetation Condition after fire (RAVG, Miller 2007) to determine percentage of over story canopy that was killed during the fire based on estimated basal area loss (Miller 2007).

Existing Condition

Throughout the Rogue River-Siskiyou National Forest, wildland fire processes have been altered due to fire exclusion and timber harvest. As a result, fires are now larger and more severe than historic levels, (Campbell 2004; Hessberg 2015; Peterson 2005). Forest structure has been altered. Studies have specifically shown changes in forest types (Agee 1993; Campbell 2004; Heyerdahl 1996). Ultimately, these changes have created a set of systems that are less resilient in the wake of disturbances, such as periodic insect infestations or recurring wildfires. While the overall fire area represents a variety of fire regimes, the area proposed for treatment is well represented by Fire Regime I with a mean fire return interval of 6-15 years (Landfire 2012). The following regimes characterize the area of the Chetco Bar fire.

• Fire Regime I: 0 to 35 year frequency, low severity (less than 75 percent of dominant overstory vegetation replaced).

In northwestern California, Miller 2012 found the inter-annual mean percentage of high severity fire to be 25% across a 22 year study period. As the amount of acres burned in any given year, the amount of high severity fire decreases. For Douglas fir forests, the amount of high severity fire was around 10%. The Chetco Bar fire which occurred in similar topography, climate and vegetation experienced 39% high severity.

When compared with the RAVG map severity classifications, all of the treatment units are classified as having lost 75 to 100 percent of pre fire basal area. This provides a framework to compare departure from HRV and description of condition class.

Desired Condition

Lands managed by the Rogue River-Siskiyou National Forest would be in and maintained in condition class 1, or less than 33% departure. Fire behavior, effects, and other associated disturbances would be similar to those that occurred prior to fire exclusion (suppression) and mimic the natural fire regime. Composition and structure of vegetation and fuels characteristics would be similar to the conditions that existed under the historical fire regime. Risk of loss of key ecosystem components would be reduced.

Environmental Consequences

Methodology

As outlined in the purpose and need, the project is focused on specific areas meeting a defined set of criteria to provide data to inform management. These criteria focus on areas of high severity and mortality and must also fall with in matrix land classification. By using remotely sensed data through the Rapid Assessment of Vegetation Condition after Wildfire (RAVG) map, compared to conditions prior to the fire, a comparison can be made.

Spatial and Temporal Context for Effects Analysis

This analysis is limited to those areas of high basal area loss according to RAVG assessment and within matrix land allocation. Due to the overall fragmented and small size of these treatment areas, the action alternatives are unlikely to have effects on fire behavior and spread at a larger scale. This analysis uses the high severity patches found in matrix. According to the rapid assessment performed in the fall of 2017, approximately 13,626 acres were identified as meeting these criteria. Based on research comparing fuel loading profiles in treated and untreated stands post fire (Brown 2003; Dunn 2012, 2015; Peterson 2014), the short-term timeframe is within the next 5-10 years and the long-term time frame is 20 years. These time frames are based on the earliest average threshold for when live fuels again occupy the site and approach full occupancy and when surface fuel loadings begin to hit equilibrium between unlogged and logged stands and when post-fire fuel loading effects tend to diminish regardless of treatments (Peterson 2014).

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

Management actions that occurred in this area including fire suppression and timber management activities have contributed to the fuel loading and departure from historic structural conditions. The impact of the Chetco Bar Fire itself has been the most significant activity relevant to this project and is likely to remain so in the near term. These treatment areas reflect approximately 1-2% of the overall fire area, and 2-4% percent of the high severity patches within the fire.

Within the initial scoping letter 13,626 acres of high severity matrix land was proposed for analysis, the action alternatives would treat approximately 14-30% of these initial acres. The impact of this treatment in the treated areas would result in reduced coarse woody debris and snag density but increased fine fuels (Dunn 2015; Peterson 2014). In the short term, (5-10 years) and within these treated areas, we can expect higher flame lengths and rates of spread compared to untreated areas, it is expected that the effect on fire behavior created by these conditions would be over ridden by the increase of live fuels (brush) sometime after 10-15 years.

Within the action alternatives, reduced snag densities can enhance the range of suppression options and improve access and fire fighter safety. Areas adjacent to treatment units will remain untreated, this will reduce continuity in fuels and overall fire danger in the near term, mitigating the potential for fire spread from these treatment units. "Reducing connectivity of surface fuels at landscape scales is likely the only way to decrease the size and severity of reburns until vertical diversification and fire resistance is achieved.” (Thompson et al, 2007) From a fire standpoint the changes in fuels continuity on the landscape due to this project is considered negligible in the context of the broader event.

Table 2. Project design criteria for fire and fuels Criteria number

	Objective	Design criteria	Alternative
Fuels	Activity fuels generated by harvesting are distributed across the treatment units to allow for safe fire suppression.	Fuel bed depth 12” or less within the treatment units.	Action alternatives

Alternative 1 – No Action

Direct and Indirect Effects

Fire and fuels management are often discussed as a concern in post-fire environments because of the changes in fuel loading, composition, and continuity after wildfire. Recent research (Donato 2013; Dunn 2012 and 2015; McGinnis 2010; Monsanto and Agee 2008; Richie 2013) does not consistently validate this concern.

The density of large, dead, over story trees can provide a safety concern for firefighters, resulting in limiting the strategies available during fire suppression operations. This is likely to be reduced over time as these trees fall. Standing snags influence fire spread by acting as a source and as a receptive fuel from embers. (Van Wagtendonk 2006). Over time as snags fall they will contribute to surface fuel loadings and increase fire residence time as large logs can burn for long periods. (Brown et al. 2003, Monsanto and Agee 2008).

As live fuels (shrub layer, young conifer regeneration) become more homogenous, (generally >10 years) they will become the dominant fuel loading to influence fire spread. When this shrub layer becomes more continuous and before the snags fall there is a period where the fine dead branches fall and can become suspended off the ground within the shrub canopy. Suspended dead wood decays much slower than wood in contact with the ground (Harmon et al. 1986). This suspended material can add to the fuel load and increase fire behavior intensity and rate of spread.

Just over 48 percent, or 91,118 acres within the fire perimeter are classified as having 50 percent or more basal area loss. Of this, 13,626 acres or 8 percent of this high severity area is designated as matrix under the Northwest Forest Plan. Because the patch sizes (treatment units) under consideration are small and within larger patches of high basal area loss, the lack of treatment in these specific patches is unlikely to contribute to success or failure of fire suppression activities. In the longer term, (>20 years) increased shrub continuity and snag decomposition will reduce firefighter effectiveness and pose safety hazards for safe suppression options.

Cumulative Effects

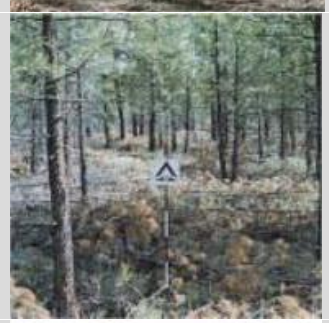
Because there are no direct or indirect effects, no cumulative effects would occur.

Effects common to Action Alternatives

Direct and Indirect Effects

Fuel loading within the treatment units would increase immediately post-harvest. As coarse fuels would be removed during harvest, much of the fuel accumulation would consist of finer fuels, primarily in the form of branches. Fuel loadings after harvest can be considered a hazard as needles dry and turn red. Fire behavior in these units can burn with greater intensity and greater rates of spread. To meet the purpose and need of the Chetco Bar area salvage, only dead and dying trees are proposed for harvest, therefore there will be very little to no needles remaining to dry and turn red, the red slash phase lasts approximately 1-2 years. Project design criteria for the Chetco Bar Area salvage require reducing fuel bed depth to an average of 12" after harvest operations. The lack of needles, can greatly reduce rates of spread as fine fuels are recognized as the greatest contributor to fire spread. Resource concerns from soil and hydrology require some organic material to be left on site to mitigate the effects of lack of ground cover. Slash fuels remaining on site will be well represented by the SB1 and SB2 model as shown below.

Table 3-Expected Fuel Models common to action alternatives

Fuel model	Description	Photo example
SB1 (201) Low Load Activity Fuel	The primary carrier of fire in SB1 is light dead and down activity fuel. Fine fuel load is 10 to 20 tons/acre, weighted toward fuels 1 to 3 inches diameter class, depth is less than 1 foot. Spread rate moderate; flame length low.	
SB2 (202) Moderate Load Activity Fuel or Low Load Blowdown	The primary carrier of fire in SB2 is moderate dead and down activity fuel or light blowdown fine fuel load is 7 to 12 tons/acre, evenly distributed across 0 to 0.25, 0.25 to 1, and 1 to 3 inch diameter classes, depth is about 1 foot. Spread rate moderate; flame length moderate	
SB3 (203) High Load Activity Fuel or Moderate Load Blowdown	The primary carrier of fire in SB3 is heavy dead and down activity fuel or moderate blowdown. Fine fuel load is 7 to 12 tons/acre, weighted toward 0 to 0.25 inch diameter class, depth is more than 1 foot. Spread rate high; flame length high.	

Activity fuels would increase in all treatment areas in the near term. Research on fuel loading (Scott 2005) describes increased rates of spread and flame lengths based on the fuel model changes resulting from treatment. This would vary based on ambient conditions (weather and fuel moistures). Greater rates of spread and flame lengths would make suppressing fires more challenging, it is for this reason the Project Design Criteria (PDCs) limit concentrations and depth of fuels, ensuring the flame lengths are such as to allow for firefighters to suppress these fires during initial attack. Material in excess of meeting resource concerns will be redistributed within the unit or yarded to a landing to be piled and burned. In ground based units activity fuels can be piled and burned throughout the unit.

In productive fire prone systems such as the Siskiyou national forest, "fast decay may reduce the contribution of residual post-fire wood to early-seral fire potentials" (Hobbs et al 1992). Based on observations from recent fires on the Rogue River-Siskiyou National forest, this accumulated fuel is likely to remain the dominant fuel loading in the units until such time (>10 years) as live fuels, mainly brush and small conifer regeneration completely occupy the growing space on the site. As live fuels (shrub layer and young conifer) become more homogenous, they will become the dominant fuel loading to influence fire spread.

Table 3-Acres treated by Alternative

	IMPROVED ACCESS FOR FIRE SUPPRESSION	INCREASED SHORT TERM FUEL LOADS
NO ACTION	0	0
ALTERNATIVE 2	4090	4090
ALTERNATIVE 3	1868	1868

When this new shrub layer become more continuous and before the snags fall there is a period where the fine dead branches fall and can become suspended off the ground within the shrub canopy. Suspended dead wood decays much slower than wood in contact with the ground (Harmon et al. 1986). This suspended material can add to the dead fuel load and increase fire behavior intensity and rate of spread.

Standing dead trees (snags) are recognized as a safety hazard in future fires. Fire weakened trees or snags that experience fire again are weak and unpredictable and until mitigated can prohibit or delay response. Reducing the amount of snags within the treatment areas would serve to mitigate safety concerns for firefighters in these areas, allowing them to use the full range of suppression tactics available. As stated in the no action alternative, this does not significantly alter firefighting opportunities in the broader area affected by the 2017 Chetco Bar Fire, it does counter the issues raised by the initial increase of activity fuels.

Reforestation in the action alternatives will also increase the continuity of fuels on the site. Appropriate species mix and planting densities will help to ensure that there is sufficient regeneration but only in amounts required to meet reforestation requirements. Current guidelines are to achieve 125-150 trees at 4.5 feet tall per acre. The preferred method is for natural regeneration, artificial reforestation will occur where a natural seed source is not available. Young conifer regeneration will combine with shrub species to occupy the growing space on the site, when full site occupancy is realized, ambient conditions will determine when and if these live fuels are available to burn. It is anticipated that even with natural or artificial regeneration, the continuity of shrub layer will drive future fire events for the near term, overriding the influence of conifer regeneration in activity units. Allowing for unplanted areas, openings and planting at lower densities can serve to break up continuity of fuels and reduce future fires intensity and severity. In all, the effects of this treatment in terms of potential fire behavior are minimal due to the small acreage of treatments relative to the larger areas of high severity in the Chetco Bar footprint.

Cumulative Effects

Surface fuel loading in both treated and untreated areas would accumulate post-fire, beginning to decline as early as 20 years post-fire within the activity units (Peterson 2014; Ritchie 2013).   Treatment units will have greater fuel continuity after harvest, this can increase fire rates of spread. Reburn severity is often a concern after harvest activities. However, logging slash is only part of the fire risk story, and it may not be the most important after a few years. (Thompson et al, 2007) Adjacent untreated areas will retain lower fuel levels and high spatial heterogeneity which can aid in slowing fire growth. The proposed treatment areas account for only 2 percent of the high severity footprint of the Chetco Bar fire, and many of these high severity areas are in the immediate vicinity of treatment, it is expected that these treatments would have little effect on future fire management activities due to this fragmented nature of unit locations.   The treatment units are relatively isolated and small in comparison to the larger, adjacent areas of moderate and high severity. This heterogeneity is important in terms of fire spread and improved conditions into the future. The project design criteria will allow for effective fire suppression activities without further treatment.

Lands adjacent to the project footprint that are managed by other entities are also receiving some form of active management. The Bureau of land management is proposing 175 acres of harvest. Similar project design and effects are expected on BLM managed lands. Salvage harvest with reforestation will have little to no impact to this project. Private land owners with adjacent property have already implemented salvage harvest activities. These activities have been observed during the fall and winter months. Both dead and live trees were harvested, in most cases whole tree yarding or leave top attached to the last log were implemented. Resulting slash was machine piled at landings or within units for later disposal through burning. It is expected that these private lands will be reforested with higher densities of conifer seedlings. These areas will also have more continuous live fuels after 10-15 years when they fully occupy the site. Other treatments often utilized on private lands include herbicide applications to reduce the amount of brush regeneration. This reduction in brush species will create a more continuous area of conifer. These activities will reduce snags and improve access, these serve to improve firefighter safety, but may add cumulatively to the continuity of live fuels, and future fire risk.

The current extent of stand replacing fire effects are thought to be outside of the historical range of variability (Miller and Safford 2012). There are concerns that active management in post fire environments will exacerbate or provide a continuous trend of high severity fires. Surface fuel loadings and live fuels are important factors when considering reburn, however the most important variables for predicting future reburn severity are time since the last fire and fire weather, specifically average temperature, relative humidity as well as shrub cover. At longer intervals between fires, vegetation characteristics have a stronger relationship to reburn severity. (Grabinski, et al 2012)

The action alternatives identified here are not expected to impact future fire management due to the fragmented and dispersed nature of unit locations on Rogue River-Siskiyou managed lands.

Compliance with Forest Plan and Other Relevant Laws, Regulations, and Policies

Both action alternatives meet the Rogue River-Siskiyou Forest Plan direction:

12-2   The fire hazard presented by natural, activity or prior activity fuels should be reduced to appropriate levels, considering the site specific risk, and utilizing economically efficient treatment methods. The selected treatment methods should meet fuel management objectives which integrate consideration for all resource values.

12-4 Proposed activity units (harvest, thinning, conversion, release, etc.) should be designed and coordinated on the ground so that size, shape, location, timing, spatial distribution, and management risk are considered for fire management and other resource requirements and help make the fuel treatment and fire protection of the units as practical and economical as possible.

Fire intensity and spread can be reduced by implementing such measures as:

1. Reducing the fuel bed depth, especially fuels in the 0-3 inch diameter class, which will reduce the flame lengths.
2. Reducing the amounts of large-diameter fuels on the site, which will reduce the total burning residence time and reduce the total amount of heat pulsed into the soil.
3. Reducing the amount of snags in treatment areas will improve access and enhance firefighter safety.

The no action alternative does not result in a short-term increase in activity fuel loading and this meets Rogue River-Siskiyou Forest Plan goals for fire management.

The action alternatives aim for maintaining activity generated fuel levels within the capabilities of initial attack firefighting resources and provides improved safety and access to the treated areas by reducing snag density.

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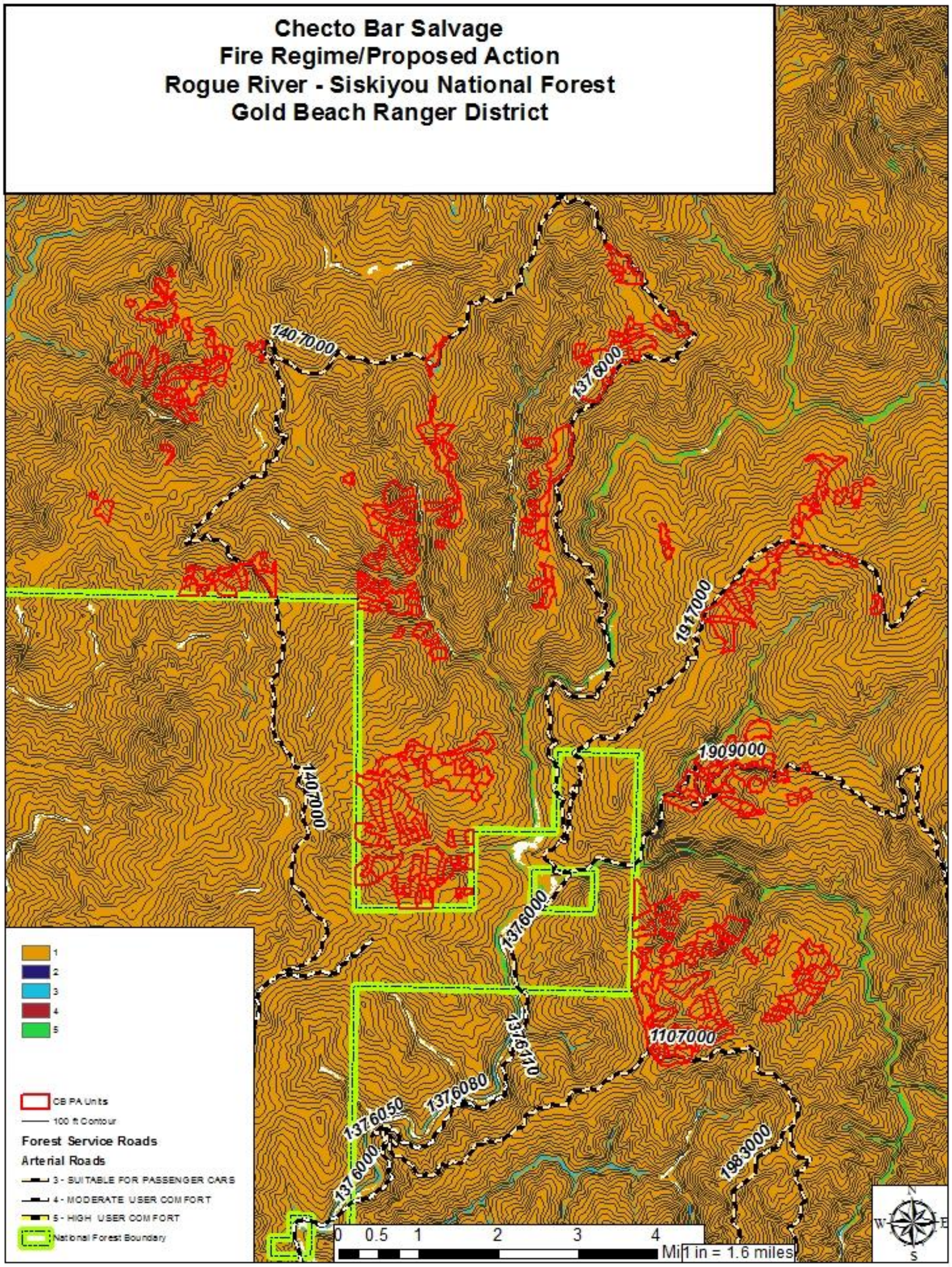
Appendix



Checto Bar Salvage
Fire Regime/Proposed Action
Rogue River - Siskiyou National Forest
Gold Beach Ranger District
14070.00
1376000
1407000
1917000
1909000
1376000
1107000
1376170
1376080
1376050
1376000
1983000
1
2
3
4
5
CB PA Units
100 ft Contour
Forest Service Roads
Arterial Roads
3 - SUITABLE FOR PASSENGER CARS
4 - MODERATE USER COMFORT
5 - HIGH USER COMFORT
National Forest Boundary
0 0.5 1 2 3 4
Mi
1 in = 1.6 miles
N
W
E
S